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ABSTRACT

Designed to measure children's abilities to synthesize concepts from several sources, this measure is based on the assumptions that children move from the concrete to the abstract, from specific to generic, and that the ability to synthesize and form new concepts is an important prerequisite to reading comprehension. Each form of the test is divided into three parts, with the first part focusing on letters, the second part on words, and the third part on stories. (This document is one of those reviewed in The Research Instruments Project (TRIP) monograph "Measures for Research and Evaluation in the English Language Arts, Volume 2," published by the Committee on Research of the National Council of Teachers of English in cooperation with the ERIC Clearinghouse on Reading and Communication Skills. The TRIP review, included here as an introduction to the instrument, describes the instrument's category (reading), title, author, date, age range (7-11 years), purpose, and physical characteristics.) (JL)

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ED236645

A Tentative Criterion-Referenced Test to Measure Thinking Processes, Form A and B.

The measurement instruments contained in this document have been reviewed in a monograph (cited below) edited by William T. Fagan, Charles Cooper, and Julie Jensen, for The Research Instruments Project (TRIP), and funded by a grant from the Trustees of the NCTE Research Foundation:

Measures for Research and Evaluation
in the
English Language Arts
Volume II

The purpose of the editors has been to select and review measurement instruments pertaining to all aspects of research and evaluation in the English language arts, e.g. language and language development, literacy, literature, reading (including comprehension, teacher-pupil interaction, etc.), writing, and teacher knowledge and attitudes. In order to make some of the actual instruments reviewed more readily available, the ERIC Clearinghouse on Reading and Communication Skills (ERIC/RCS) has cooperated with the editors by processing selected instruments into the ERIC system (see the 42 documents assigned Clearinghouse accession numbers CS 207 904-945).

CS 207920

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Category: Reading

Title: A Tentative Criterion-Referenced Test to Measure Thinking Processes, Form A and B

Author: Jo Ellen Oliver

Age range: Seven to eleven

Description of the Instrument:

Purpose: The test was devised to measure children's abilities to synthesize concepts from several sources.

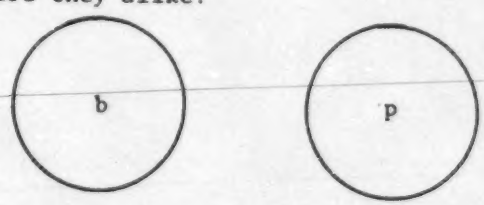
Date of Construction: 1978

Physical Description: As assumption was made that children move from the concrete to the abstract, from specific to generic, and that the ability to synthesize and form new concepts is an important prerequisite to reading comprehension. Each form of the test is divided into three parts with Part I focussing on letters, Part II on words, and Part III, on stories. Children's responses to these items are labelled as perceptual or conceptual, with conceptual scores indicating a more developed ability to generalize and synthesize. The test is written on a primer level of difficulty, is easy to score (scoring guidelines are included), and requires about thirty minutes to complete. The test may be administered individually or in groups.

Sample items from each of the three sections of Form A are given below:

I. A. Look at what is in the circles.

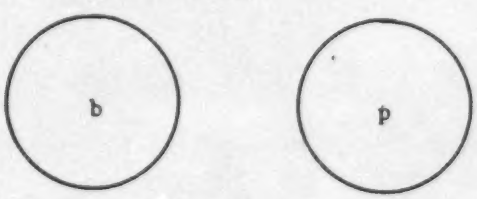
How are they alike?



1.
2.

B. Look at what is in the circles.

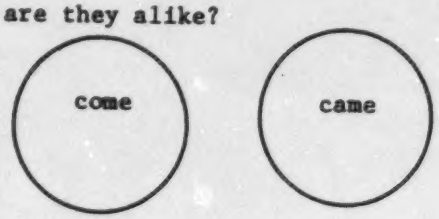
How are they different?



1.
2.

II. A. Look at what is in the circles.

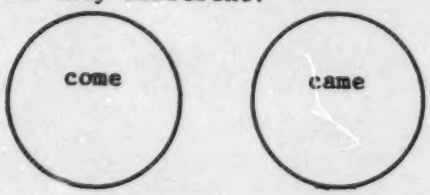
How are they alike?



1.
2.

B. Look at what is in the circles.

How are they different?



1.
2.

III. (With reference to two stories, The Ant and the Grasshopper, and The Little Red Hen, the following questions are asked):

A. 1. Who worked hard in the story The Little Red Hen?

Who worked hard in the story The Ant and the Grasshopper?

2. Were there some animals in both of the stories who were lazy?

3. Who got to eat in both of the stories?

B. How are these two stories alike?

1.

2.

C. How are these two stories different?

1.

2.

D. 1. How do you feel about the way the hen and the ant acted?

2. How do you feel about the way the other animals acted?

3. Describe which animal in the stories you would like to be and tell how you would have acted.

4. What did you learn from the stories?

Validity, Reliability, and Normative Data:

The form of the test (criterion-referenced) was inspired by Otto (1973) who in his discussion of criterion-referenced and norm-referenced tests, said of criterion-referenced tests "they get directly at the performance of individuals with regard to specified individual objectives" (p. 18)

The first draft of the test was devised based on criteria established by Stauffer (1969) for consideration in the construction of an instrument to measure thinking processes.

The test was tried on a number of children and then submitted for scrutiny to two college professors and a seminar of 30 doctoral students in reading. Their suggestions were incorporated into a revised form and its alternate form. These forms were then submitted for evaluation to four college professors, with backgrounds in testing and child development, to establish content validity. To establish partial construct validity, the test or its alternate was administered randomly to 30 fifth-grade children. These children were then given 90 minutes of training in the conceptualization process. After eight days had elapsed, the children were given the alternate form of the test they had taken previously. A paired t test was performed. For the Total scores, the t value was 2.41 ($p<.05$). For Conceptual scores only, the t value was 3.23 ($p<.005$). Mean Total points increased 2.50, Mean Conceptual points increased 2.6.

To establish cross-form reliability, 100 fifth-graders in a different school were randomly given Form A or Form B. Twelve days later, the children were given the alternate forms of the tests they had taken. Children were given no training. Cross-form reliability (based on a Pearson product-moment correlation) for the Total test score was .80 ($p<.001$). For the Conceptual scores on the tests, cross-form reliability was .74 ($p<.01$). The correlations between the two

scores of the tests, Conceptual and Total, were .89 ($p<.001$).

Interrater reliability based on the independent scoring by two raters was .99 for the Total test scores and .99 for the Conceptual scores.

Related Documents:

Oliver, Jo Ellen. The effects of training in synthesis-level conceptualization upon low-achieving first and fifth graders involved in a literature-based cross-age tutoring program. Unpublished doctoral dissertation, University of Georgia, Athens, 1978.

Otto, W. Evaluating instruments for assessing growth in reading. In W.H. MacGinitie (ed.), Assessment problems in reading. Newark, Deleware: International Reading Association, 1973. ED 082 138

Stauffer, R. G. Teaching reading as a thinking process. New York: Harper and Row, 1968. ED 041 704

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Criterion Objectives, Directions for Administration, and Scoring Instructions for Form A of A Tentative Criterion-Referenced Test to Measure Thinking Processes

I. Objectives

Part I--The child will be able to distinguish between the letters "p" and "b," and "A" and "a" by telling how they are alike and how they are different.

Part II--The child will be able to distinguish between the words "come" and "came," and "cat" and "cow" by telling how they are alike and how they are different.

Part III--The child will be able to read and compare two similar stories by: (A) relating factual detail, (B) extracting similar elements in the stories, (C) identifying dissimilar elements in the stories, and (D) expressing a personal reaction to at least one idea in both of the stories.

II. Directions

Here are some samples of the kinds of responses children may make. More points (2) should be given for conceptual (classification or comparison) types of responses, although the perception-based responses (recall) are scored (1). Parts I and II deal with letters and words, Part III with stories.

III. Scoring

Using criteria given in the section on sample responses and scores, score +1 for perceptual responses, and +2 for conceptual responses. A total of 8 perceptual points are possible on Part I if no conceptual responses are made. A total of 16 conceptual points are possible if no perceptual responses are made. The same is true for

Part II. Most children will answer with a combination of perceptual and conceptual responses. If a child gives a perceptual answer on, for example I.A.1., give him 1 point. If he gives a conceptual answer give him 2 points. If he gives 2 perceptual answers on I.A.1. or I.A.2., still just give him 1 point. If he gives a perceptual answer on both I.A.1 and I.A.2., give him 1 point for each. On Part III, give only 1 point for A.1., 2., 3., but B. and C. can be either +1 or +2 for each answer. Part D requires 2 points for each response. Note: Responses do not have to be in the same order as stated here. A child can respond to the same stimuli with 0+1, +10, 0+2, +20, +1+1, +1+2, +2+1, or +2+2.

Some Sample Responses and Scores--Form A of A Tentative Criterion-Referenced Test to Measure Thinking Processes

Score Sheet

Part I		Part II		Part III	
Perceptual	Conceptual	Perceptual	Conceptual	Perceptual	Conceptual

Total Conceptual _____

I. A. Give credit for any one of the following.

+1 1. They both have circles. They both have stems.

+2 2. They both are letters of the alphabet, or they both are "little letters" or lower-case.

B.

+1 1. In one, the stem goes up. In the other, the stem goes down.

+2 2. One is the sound that starts "boy" (or any other "b" word) and one is the sound that starts "pig" (or any other "p" word).

C.

+1 1. They each have at least one straight line in them.

+2 2. They both are letters of the alphabet or they both are A's.

D.

+1 1. One has a circle and a straight line, and one has three straight lines.

+2 2. One is a capital letter (or "big" letter) and one is a lower-case letter (or "small" letter). But, to say "one letter is bigger," limits the response to one of perception.

II. A. Give credit for any one of the following.

+1 1. They each have a "c," and "m," and an "e," or both start with "c."

+2 2. They say "almost the same thing." They are part of the same verb. They both show action. Both are words.

B

+1 1. One has an "a" and one has an "o" in it. One letter is different.

+2 2. One means "now" and one means you already did it (past and present tense). They are part of the same verb.

C

+1 1. Both start with c. Both have three letters.

+2 2. Both are animals. Both are words.

D

+1 1. They are different letters, except for "c."

+2 2. They are different kinds of animals.

III. A. Give credit for one of the following.

+1 1. The hen. The ant. (Both must be named here.)

+1 2. The grasshopper, duck, dog.

+1 3. The hen and the ant.

B

+1 1. Both are animal stories. The grasshopper and the hen did the same thing.

+2 2. They both say that if you don't work, you don't eat.

C

+1 1. One is about an ant and a grasshopper, and the other is about a hen, duck, cat, and dog (or one is about bread).

+2 2. The ant was meaner than the little red hen because the grasshopper would probably die in the snow (or some similar comparative response).

D 1. or 2. no score

+2 3. I would work if I were the grashopper. I would share if I were the hen, etc.

+2 4. You should share, we should work to eat, I should feed the hungry, etc.

Score Sheet

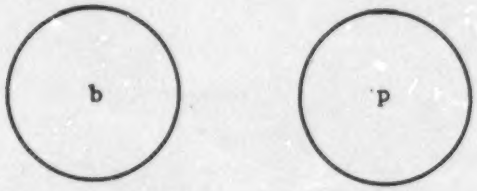
Part I		Part II		Part III	
Perceptual	Conceptual	Perceptual	Conceptual	Perceptual	Conceptual

Total Conceptual _____

A Tentative Criterion-Referenced Test to Measure Thinking Processes--Form A

I. A. Look at what is in the circles.

How are they alike?



1.
2.

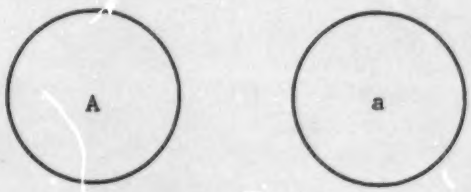
B. Look at what is in the circles.

How are they different?

1.
2.

C. Look at what is in the circles.

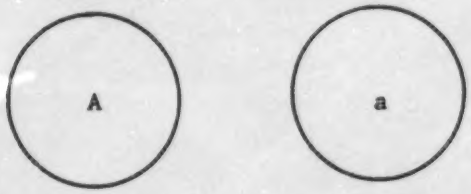
How are they alike?



1.
2.

D. Look at what is in the circles.

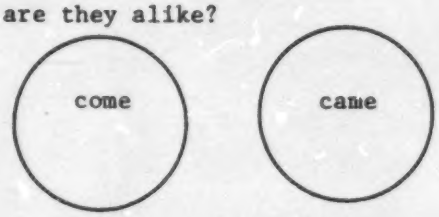
How are they different?



1.
2.

II. A. Look at what is in the circles.

How are they alike?



1.
2.

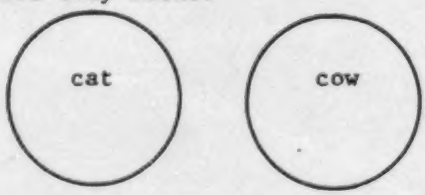
B. Look at what is in the circles.

How are they different?

1.
2.

C. Look at what is in the circles.

How are they alike?



1.
2.

D. Look at what is in the circles.

How are they different?

1.
2.

III. Read these two stories:

The Ant and the Grasshopper

"Hello Ant," said a grasshopper.
"Will you come and play with me?"
The ant said, "I cannot play with you. I have work to do."
"Don't work," said the grasshopper.
"When do you play, little ant?"
"I don't have time to play," said the ant.
"I'm looking for food.
I'm going to put the food away.
And when the snow comes, I will have food to eat."

"Work away!" said the grasshopper.
"I'm going to play now."
And away he went into the grass.

The ant was still working.
She called, "You can play, but I will work.
And I will have food to eat when the snow comes."

The snow came in the night. Down, down, down, it came.
When the grasshopper saw the snow, he said, "What am I going to do?"
"I can't play now."
I want some food, but what can I eat?"

The ant saw the grasshopper in the snow.
She called, "What are you doing here?
Are you looking for something?"

"Yes, I am," said the grasshopper.

"I'm looking for you.

"Help me, little ant.

"Let me have something to eat."

But the ant said, "NO.

"You played when I worked.

"You didn't work, Grasshopper."

And away she went.

"Stop!" called the grasshopper.

"Don't go away."

He called and called, but the ant did not stop.

And the grasshopper walked away.

On and on he went in the snow.

The Little Red Hen

Once upon a time there was a little red hen, and white duck, a dog, and a cat.

"Who will help me plant the wheat?" asked the little red hen.

"Not I, said the white duck.

"Not I," said the dog.

"Not I," said the cat.

"Then I will," said the little red hen.

One day the little red hen said, "Who will help me harvest the wheat?"

"Not I," said the white duck.

"Not I," said the cat.

"Then I will," said the little red hen. And she did.

The little red hen said, "Who will help me thresh the wheat?"

"Not I," said the white duck.

"Not I," said the dog.

"Not I," said the cat.

"Then I will," said the little red hen. And she did.

Next, the little red hen said, "Who will help me bake the bread?"

"Not I," said the white duck.

"Not I," said the dog.

"Not I," said the cat.

"Then I will," said the little red hen. And she did.

"Who will help me eat the bread?" asked the little red hen.

"I will," said the white duck.

"I will," said the dog.

"I will," said the cat.

"No, you won't," said the little red hen.

"You did not help me sow the wheat."

"You did not help me harvest the wheat."

"You did not help me thresh the wheat."

"You did not help me bake the bread."

"I will eat all the bread." And she did.

III. A. 1. Who worked hard in the story The Little Red Hen?

Who worked hard in the story The Ant and the Grasshopper?

2. Were there some animals in both of the stories who were lazy?

3. Who got to eat in both of the stories?

B. How are these two stories alike?

1.

2.

C. How are these two stories different?

1.

2.

D. 1. How do you feel about the way the hen and the ant acted?

2. How do you feel about the way the other animals acted?

3. Describe which animal in the stories you would like to be and tell how you would have acted.

4. What did you learn from the stories?

Criterion Objectives, Directions for Administration, and Scoring Instructions for Form B of A Tentative Criterion-Referenced Test to Measure Thinking Processes

I. Objectives

Part I--The child will be able to distinguish between the letters "b" and "d," and "M" and "m" telling how they are alike and how they are different.

Part II--The child will be able to distinguish between the words "run" and "ran" and "fish" and "frog" by telling how they are alike and how they are different.

Part III--The child will be able to read and compare two similar stories by: (A) relating factual detail, (b) extracting similar elements in the stories, (C) identifying dissimilar elements in the stories, and (D) expressing a personal reaction to at least one idea in the stories.

II. Directions

Here are some samples of the kinds of responses children may make. More points (2) should be given for classification (conceptual), types of responses, although the perception-based responses (1) are also important. Parts I and II deal with letters and words, Part III with stories.

III. Scoring

Score +1 for perceptual responses, and +2 for conceptual responses. A total of 8 perceptual points are possible on Part I if no conceptual responses are made. A total of 16 conceptual

points are possible if no perceptual responses are made. The same is true for Part II. Most children will answer with a combination of perceptual and conceptual responses. If a child gives a perceptual answer on, for example I. A. 1., give him 1 point. If he gives a conceptual answer give him 2 points. If he gives 2 perceptual answers on I. A. 1. or I. A. 2., still just give him 1 point. If he gives a perceptual answer on both I. A. 1. and I. A. 2., give him 1 point for each. On Part III, give only 1 point for A. 1., 2., 3., but B. and C. can be either +1 or +2 for each answer. Part D requires 2 points for each response. Note: Responses do not have to be in the same order as stated here. A child can respond to the same stimuli with 0+1, +10, 0+2, +20, +1 +1, +1 +2, +2 +1, or +2 +2.

Some Sample Responses and Scores--Form B
of
A Tentative Criterion-Referenced Test to
Measure Thinking Processes

Score Sheet

Part I		Part II		Part III	
Perceptual	Conceptual	Perceptual	Conceptual	Perceptual	Conceptual

Total Conceptual _____

I. A.

+1 1. They both have circles. They both have lines (or stems). One of these responses is worth one.

+2 2. They both are letters of the alphabet or they both are "little letters" or lower case.

B.

+1 1. In one the circle goes left, in one it goes right; or, they are turned different ways.

+2 2. They are different letters because they sound different or they spell different words.

C.

+1 1. They both have at least one line, or they both have two humps or parts.

+2 2. They both are "m," or they both are letters of the alphabet.

D.

+1 1. One is tall and one is short, or one has curved lines and one has all straight lines.

+2 2. One is a capital and one is lower case or little. But to say "one letter is bigger," limits the response to one of perception.

II. A.

+1 1. They both have three letters, or they both have "r" and "n."

+2 2. Both are words, both are verbs, both say to do the same thing (almost).

B.

+1 1. One has a "u" and one has an "a."

+2 2. One is present tense and one is past, or one says to run now and one says to run in the past.

C.

+1 1. Both start with "f"; both have four letters.

+2 2. Both are living creatures, both are words, both are water animals.

D.

+1 1. Some of the letters are different.

+2 2. One hops and one swims, one is green, one has legs while one has fins, etc.

III. A.

+1 1. The farmer and the mouse. The farmer couldn't sleep and the mouse wanted better food.

+1 2. No.

+1 3. They went home.

B.

+1 1. The stories both had someone who went to the city and then went home.

+2 2. Both stories showed that sometimes home is better, or sometimes the grass is greener somewhere else, or sometimes we think it is better to be somewhere else when we are better off at home.

C.

+1 1. One is about a farmer and one is about a mouse.

+1 One found the city too noisy and one was chased by the cat.

+2 2. In one story the character was just unhappy because of noise, but in the other story the life of the character was in danger.

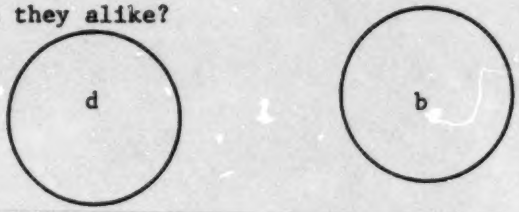
D.

+2 1. Accept any synthesis of ideas which makes sense: "I think people should be glad for what they have at home," or "I think people should stay in the city so they can get ahead and learn something, etc."

A Tentative Criterion-Referenced Test to Measure
Thinking Processes--Form B

I. A. Look at what is in the two circles.

How are they alike?

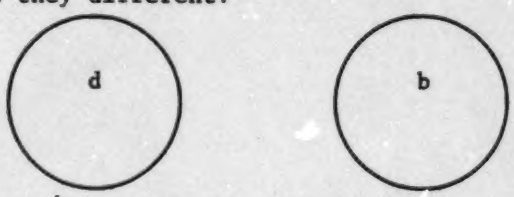


1.

2.

B. Look at what is in the two circles.

How are they different?

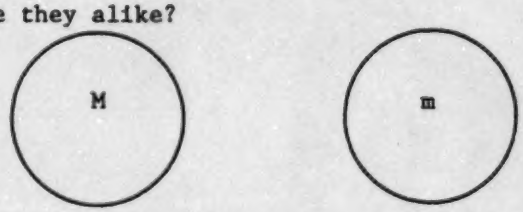


1.

2.

C. Look at what is in the two circles.

How are they alike?

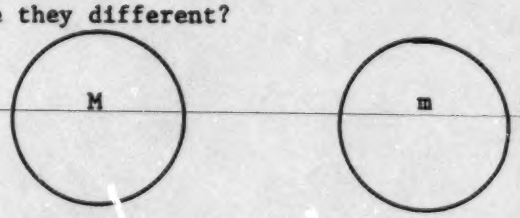


1.

2.

D. Look at what is in the two circles.

How are they different?

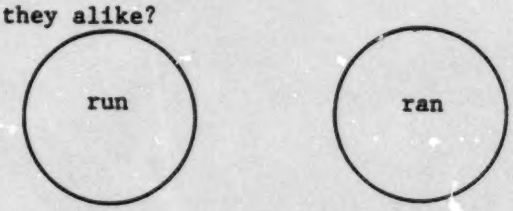


1.

2.

II. A. Look at what is in the two circles.

How are they alike?

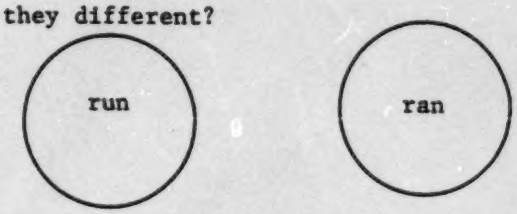


1.

2.

B. Look at what is in the two circles.

How are they different?

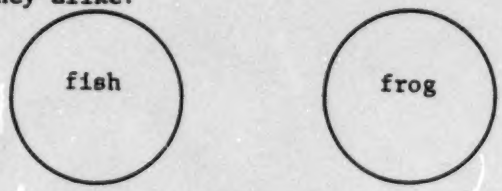


1.

2.

C. Look at what is in the two circles.

How are they alike?



1.

2.

D. Look at what is in the two circles.

How are they different?

1.

2.

III. Read these two stories:

The City Mouse and the Country Mouse

Once there were two mice, City Mouse and Country Mouse.

Country Mouse said, "I am tired of the country. I will go to the city. I will go see my friend in the city. I will surprise City Mouse."

Away he went to the city. After a long time, he came to the place City Mouse lived. City Mouse was happy to see him.

"Are you hungry?" City Mouse asked Country Mouse. I know where we can get some food. We will go to the house. The people will be in bed. They will not catch us."

They went into the house. They saw a big table with food on it.

"Jump up here, said City Mouse. When Country Mouse jumped, he saw some food. "Oh, Boy!" he said. "This is good." We don't have such good food in the country. I may not go home. I would like to stay here in the city."

"You don't have to go home," said City Mouse. "You can stay here with me."

Suddenly they saw something big. "Run! Run, Country Mouse, shouted City Mouse.

Away ran Country Mouse. They ran out of the house.

When they were safe, City Mouse called, "Stop, Country Mouse, Come back! The cat is gone."

But Country Mouse did not stop. He ran and ran back to the country. He said, "I will not live in the city. I will stay home and eat country food."

The Farmer in the City

A farmer said, "I cannot sleep in the country. My animals make too much noise."

At night when the farmer went to bed, the goat said, "Maa-maa."

The duck said, "Quack, quack."

The cow said, "Mooo-mooo."

The farmer said, "I will go to the city. Maybe I can sleep there."

The animals saw the farmer go. They were very sad.

The farmer came to the big city. He saw many streets. He saw buses and cars. He saw many buildings.

"There is no cow here," said the farmer. "There is no duck. And there is no goat. Maybe I can sleep here."

That night the farmer went to bed, but he did not go to sleep. Do you know why? The cars went up and down the street. They did not stop.

The farmer said, "I cannot sleep here. The cars make too much noise. I will go home."

The animals were happy to see the farmer.

The duck said, "Quack, quack."

The goat said, "Maa-maa."

The cow said, "Mooo-mooo."

But the farmer did not hear them. He was already asleep in his bed.

III. A. 1. Who was unhappy in the country at the beginning of The City Mouse and the Country Mouse? Who was unhappy in the country at the beginning of The Farmer in the City?

2. Did the people in the stories find the city better than the country?

3. Did the people in the stories stay in the city or did they go home?

B. Tell how the stories are alike.

1.

2.

C. Tell how the stories are different.

1.

2.

D. 1. How do you feel about the way the country mouse and the farmer acted?

2. Do you think it is a good idea to live some place you don't like?

3. Decide which person or animal you would like to be and tell how you would have acted.

4. What did you learn from the stories?

Table A1

Scores of Students Tested to Establish

Partial Construct Validity

Student	Pretest		Posttest	
	Total	Conceptual	Total	Conceptual
01	15	06	20	14
02	20	08	17	10
03	16	04	17	08
04	21	14	22	10
05	12	06	15	10
06	07	00	12	02
07	11	02	10	05
08	11	06	11	08
09	09	04	14	08
10	21	08	15	08
11	15	08	19	10
12	14	16	04	04
13	09	02	11	06
14	19	08	24	14
15	21	08	21	08
16	17	10	18	06
17	24	12	32	22
18	08	02	22	08
19	10	06	22	14
20	26	10	18	10
21	13	06	20	08
22	07	06	14	06
23	18	04	18	04
24	12	05	28	16
25	12	02	14	08
26	13	04	13	06
27	19	06	21	12
28	15	06	14	08
29	22	04	22	04
30	17	08	21	14

Table A2

Scores of Students Tested to Establish

Cross-Form Reliability

Student	Pretest Form A or B (1) (2)	Pretest Total	Pretest Conceptual	Posttest Form A or B (1) (2)	Posttest Total	Posttest Conceptual
01	1	11	04	2	18	08
02	1	04	02	2	05	00
03	1	24	08	2	14	04
04	1	06	06	2	03	02
05	1	30	14	2	27	14
06	1	33	20	2	33	18
07	1	35	20	2	31	18
08	1	33	24	2	34	20
09	1	06	02	2	08	02
10	1	22	08	2	18	06
11	1	15	08	2	13	02
12	1	21	08	2	27	14
13	1	18	06	2	21	06
14	1	24	10	2	29	14
15	2	12	04	1	11	02
16	2	30	14	1	33	22
17	2	17	06	1	26	18
18	2	18	12	1	30	14
19	2	28	12	1	25	10
20	2	25	14	1	27	14
21	2	19	10	1	17	06
22	2	23	10	1	27	14
23	1	33	16	2	31	18
24	1	27	14	2	28	10
25	1	23	13	2	31	18
26	1	09	04	2	08	02
27	1	18	06	2	27	10
28	1	21	12	2	23	14
29	1	19	12	2	26	18
30	1	18	08	2	19	10
31	1	19	08	2	20	10
32	1	32	16	2	28	18

Table A2 (continued)

Student	Pretest Form A or B (1) (2)	Pretest Total	Pretest Conceptual	Posttest Form A or B (1) (2)	Posttest Total	Posttest Conceptual
33	1	12	02	2	13	08
34	1	28	16	2	32	18
35	1	16	12	2	18	12
36	1	26	16	2	29	20
37	1	30	12	2	32	20
38	1	17	04	1	14	06
39	1	15	10	1	11	08
40	1	16	06	1	19	10
41	1	12	04	1	14	04
42	1	24	16	1	20	12
43	1	25	10	1	27	10
44	1	32	14	1	33	20
45	1	18	12	1	27	18
46	1	26	14	1	23	12
46	1	23	08	1	23	12
48	1	29	18	1	33	20
49	2	09	06	1	14	06
50	2	19	04	1	22	10
51	2	25	12	1	18	06
52	1	21	12	1	31	20
53	1	08	00	1	08	00
54	1	14	06	1	19	10
55	1	23	12	1	20	12
56	1	30	14	1	29	14
57	2	19	12	1	25	18
58	2	05	02	1	09	04
59	2	23	08	1	22	12
60	2	30	20	1	23	16
61	2	17	06	1	16	04
62	2	15	06	1	13	02
63	2	26	12	1	26	12
64	2	20	04	1	25	08
65	2	03	00	1	09	04
66	2	21	10	1	31	20
67	2	11	04	1	25	14
68	2	17	04	1	28	16
69	2	26	16	1	29	22
70	2	38	28	1	35	22

Table A2 (continued)

Student	Pretest Form A or B (1) (2)	Pretest Total	Pretest Conceptual	Posttest Form A or B (1) (2)	Posttest Total	Posttest Conceptual
71	1	18	10	1	18	08
72	1	20	12	1	19	10
73	2	20	10	1	28	12
74	2	24	10	1	22	08
75	2	15	04	1	14	06
76	2	20	06	1	23	06
77	2	06	02	1	15	02
78	2	30	18	1	31	20
79	1	20	12	2	20	14
80	1	24	14	2	22	10
81	1	09	02	2	10	02
82	1	21	14	2	21	14
83	1	19	08	2	19	02
84	1	19	10	2	15	02
85	1	13	06	2	12	04
86	1	10	02	2	13	06
87	1	19	08	2	27	12
88	1	06	00	2	09	00
89	1	19	06	2	21	10
90	1	18	06	2	17	04
91	1	17	04	2	11	04
92	1	23	06	2	16	02
93	1	20	06	2	20	06
94	1	31	18	2	20	08
95	1	06	02	2	10	02
96	1	11	02	2	12	04
97	1	12	04	2	26	12
98	1	18	06	2	22	06
99	1	20	10	2	26	12
100	1	15	06	2	14	06

Table A3

Scores on Tests Rated Independently by Two Readers to Establish Cross-Reader Reliability

	Conceptual Scores		Total Scores	
Student	Reader 1	Reader 2	Reader 1	Reader 2
01	12	12	22	22
02	10	10	28	28
03	10	10	20	20
04	20	20	32	32
05	10	10	27	27
06	10	10	22	22
07	20	20	33	33
08	06	06	18	18
09	12	12	18	18
10	18	18	31	31
11	02	02	08	08
12	06	06	14	14
13	07	07	15	15
14	12	12	19	19
15	12	12	25	25
16	06	06	09	09
17	16	16	32	32
18	08	08	19	19
19	04	04	17	17
20	12	12	30	30

Table A3 (continued)

Student	Conceptual Scores		Total Scores	
	Reader 1	Reader 2	Reader 1	Reader 2
21	08	08	18	18
22	16	16	26	26
23	02	02	12	12
24	12	11	16	15
25	10	08	15	13
26	16	15	24	23
27	14	15	26	27
28	12	13	23	24
29	18	16	27	25

N = 29